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Tapping the Water–Energy Nexus

130th NARUC Annual Meeting and Education Conference

Truth & Consequences: Residential Natural Gas and Electrification in a Low Carbon Future

Residential Natural Gas and Electricity

Energy, Economics, Environment, Reliability

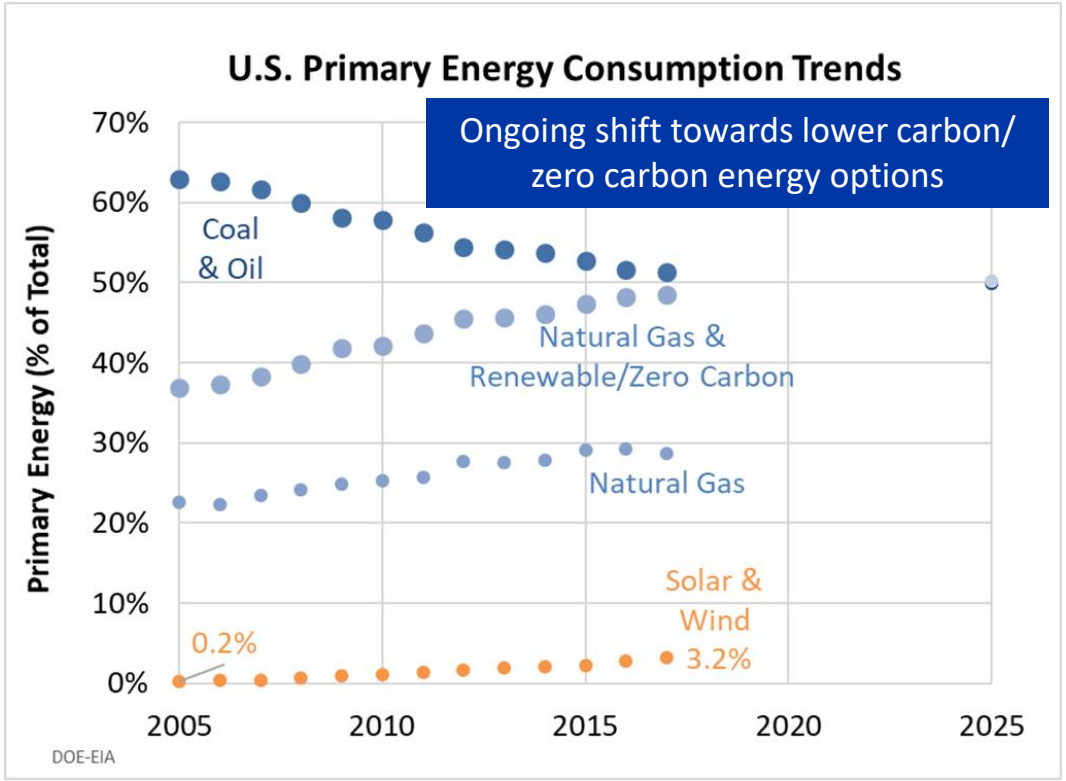
NARUC 130th Annual Meeting
November, 2018

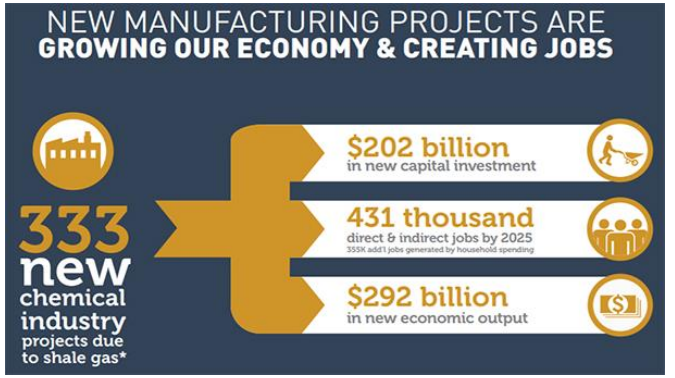
William E. Liss
Vice President, Energy Delivery & Utilization

Natural Gas, Electricity, and Decarbonization

Situational Assessment

- U.S. energy picture fundamentally shifted starting around 2005
  - Revolutionary shift to natural gas shale, growing wind & solar generation, energy efficiency
- Shale gas is a major benefit to the nation and to natural gas consumers
  - Over $75 billion annual energy savings → more spending power
  - Major improvement in U.S. manufacturing competitiveness; heightened GDP growth, jobs
- World-leading CO_2 reductions (offset coal); 28% reduction in power sector emissions

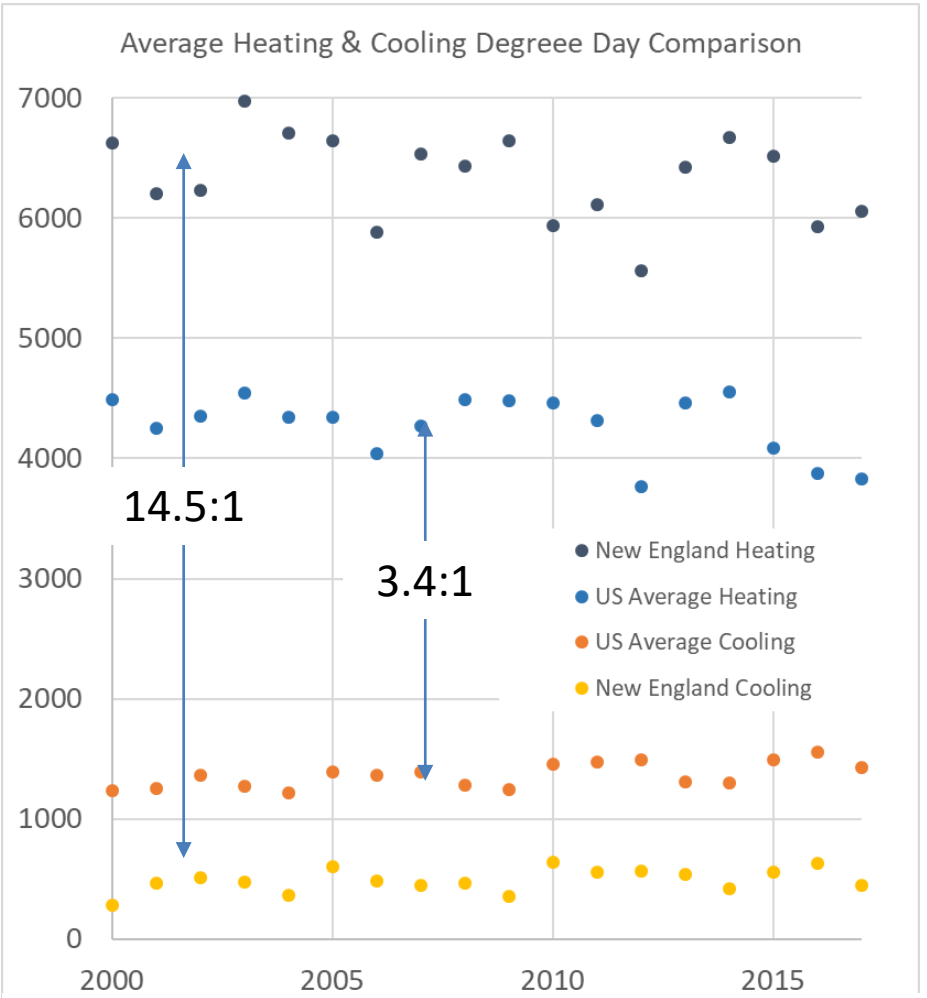




Space Heating On A Cold Day Requires Much More Energy Than Space Cooling On A Hot Day

Winter Heating from 0ºF to 70ºF …is like… **Summer Cooling from 125-145ºF to 75ºF**

Supporters of residential electrification underestimate challenges of space heating, particularly in colder climates.



Home heating requirements substantially greater than cooling.

Low Carbon Pathways

Near-Term (25-50+%)

Expanded use of high-efficiency gas equipment

Hybrid natural gas furnace and electric heat pump systems

Building envelope improvements

Next-Gen (40-60+%)

Thermal heat pumps for space & water heating

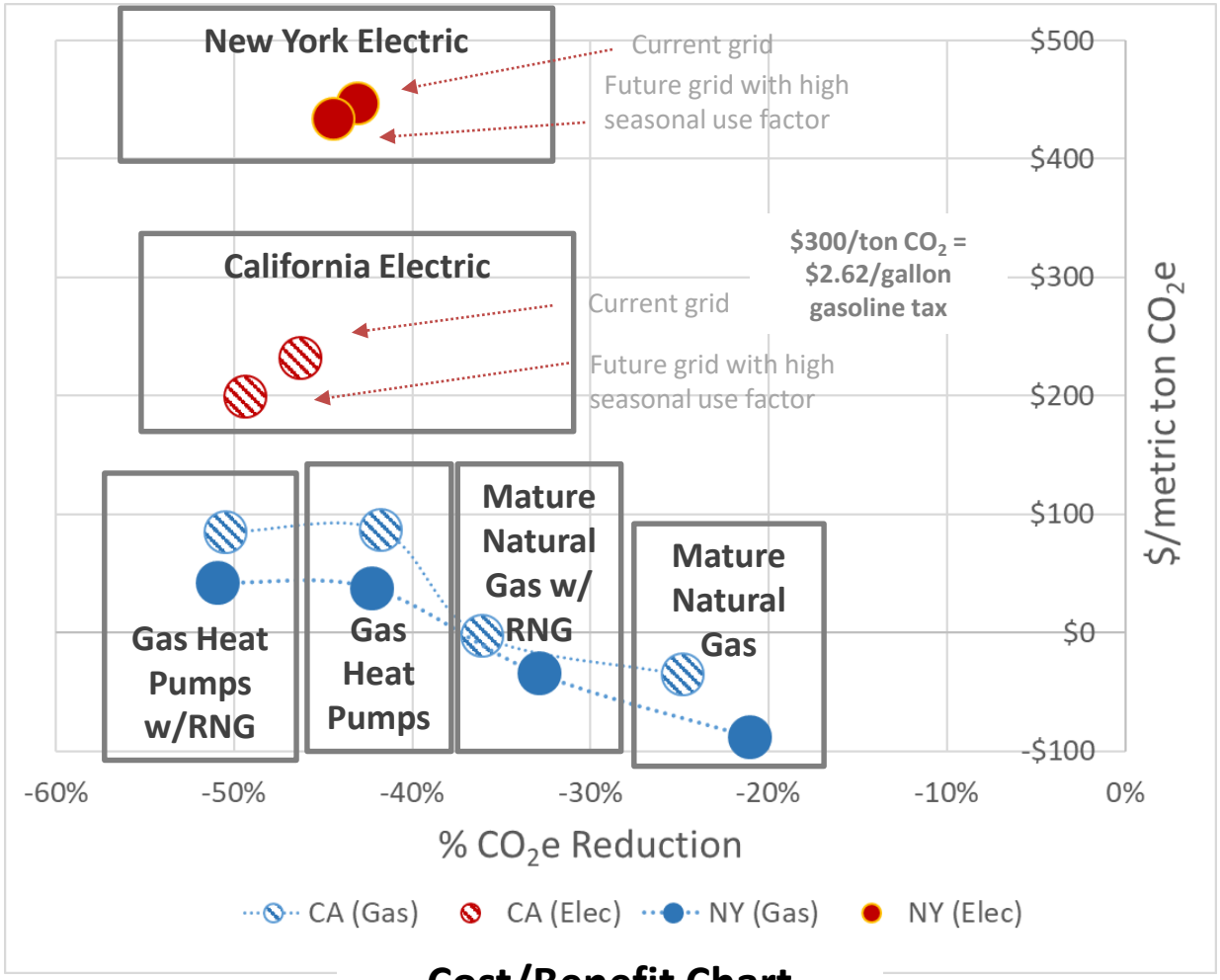
Micro CHP systems

Deep building retrofits

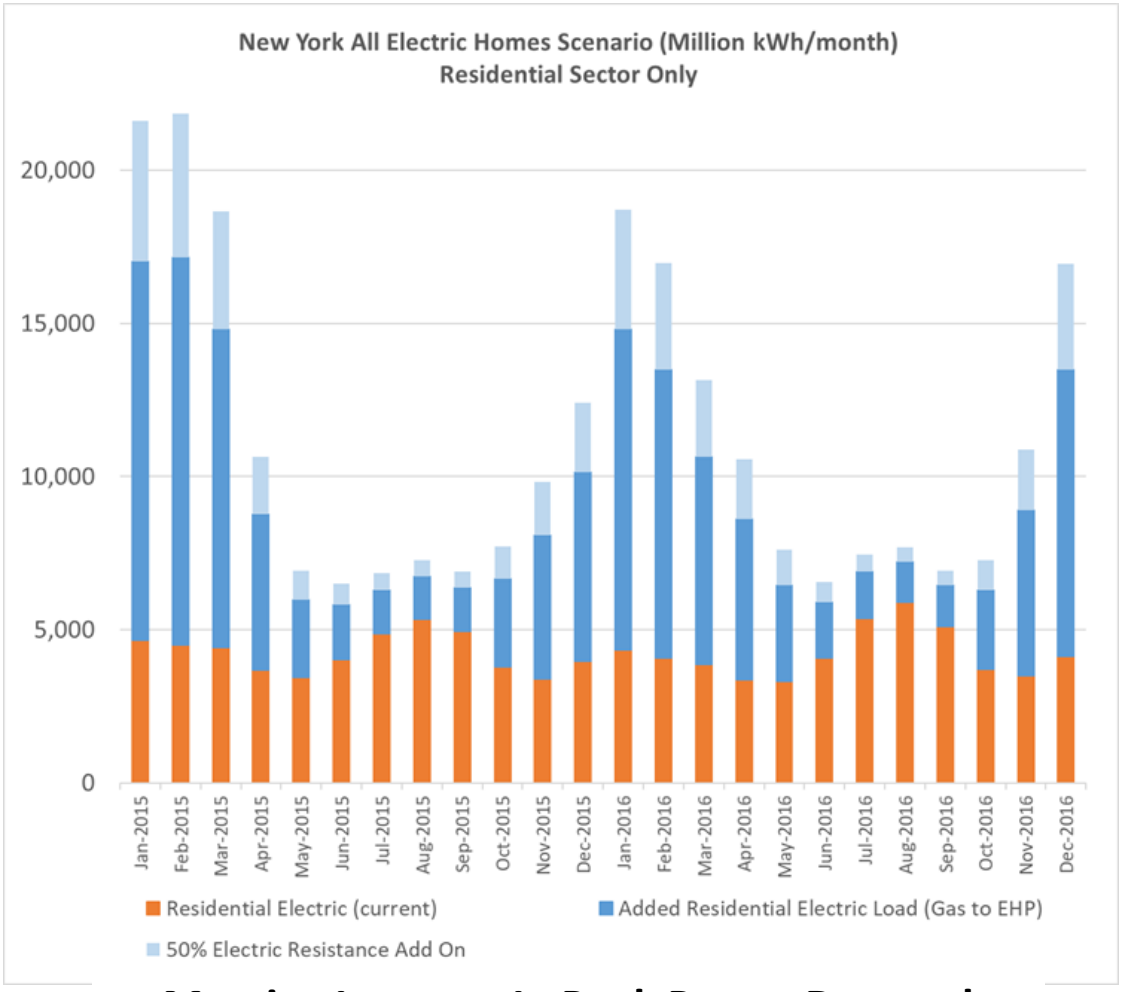
Renewables (Added 10-30%)

Renewable natural gas blends (bio-methane)

Solar thermal/natural gas space & water heating systems



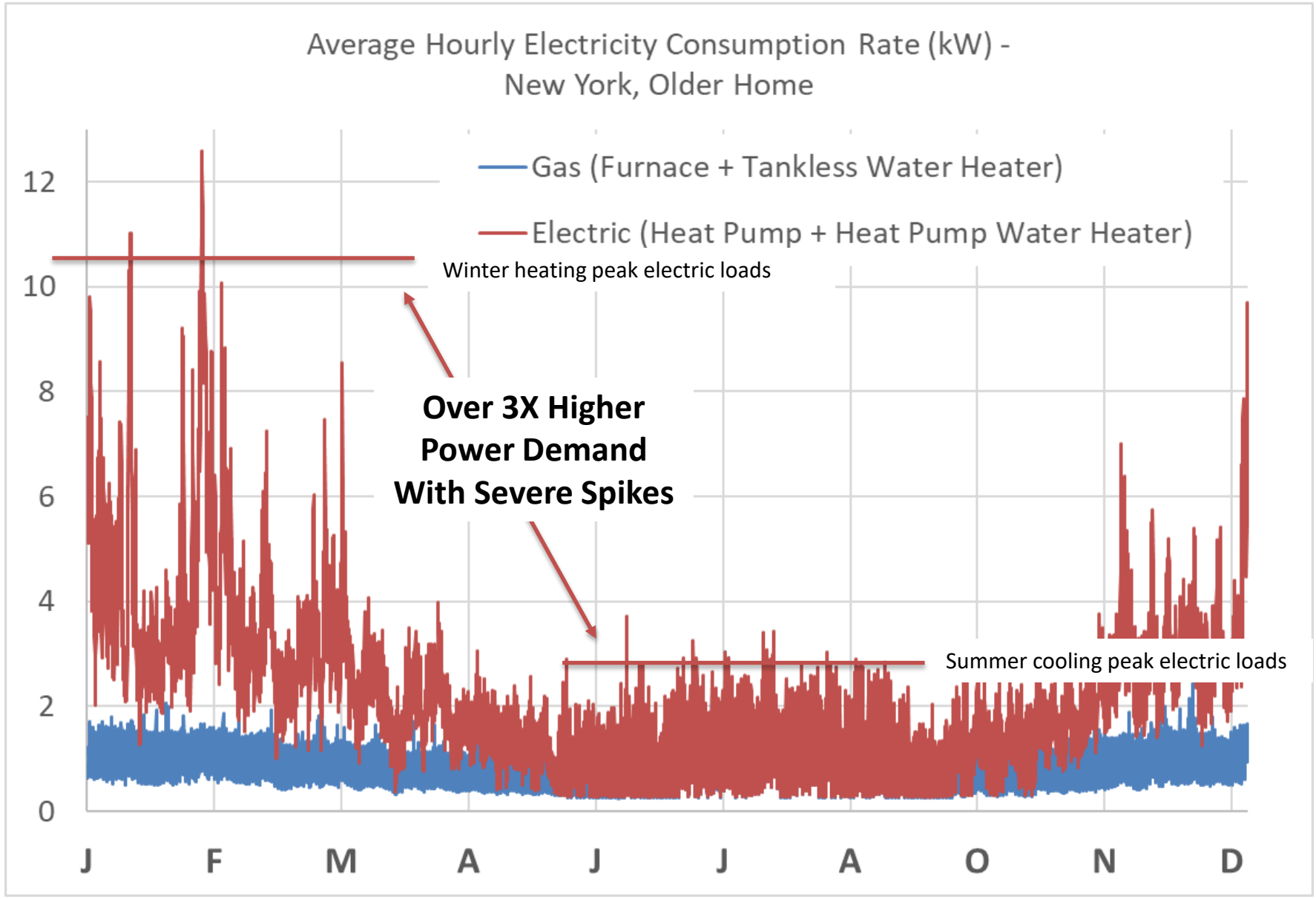
Cost/Benefit Chart



Massive Increase In Peak Power Demand

Electrification of homes an expensive carbon abatement measure. Similar to placing a $1.70-$3.50/gallon tax on gasoline. Also places large seasonal burden on electric system.

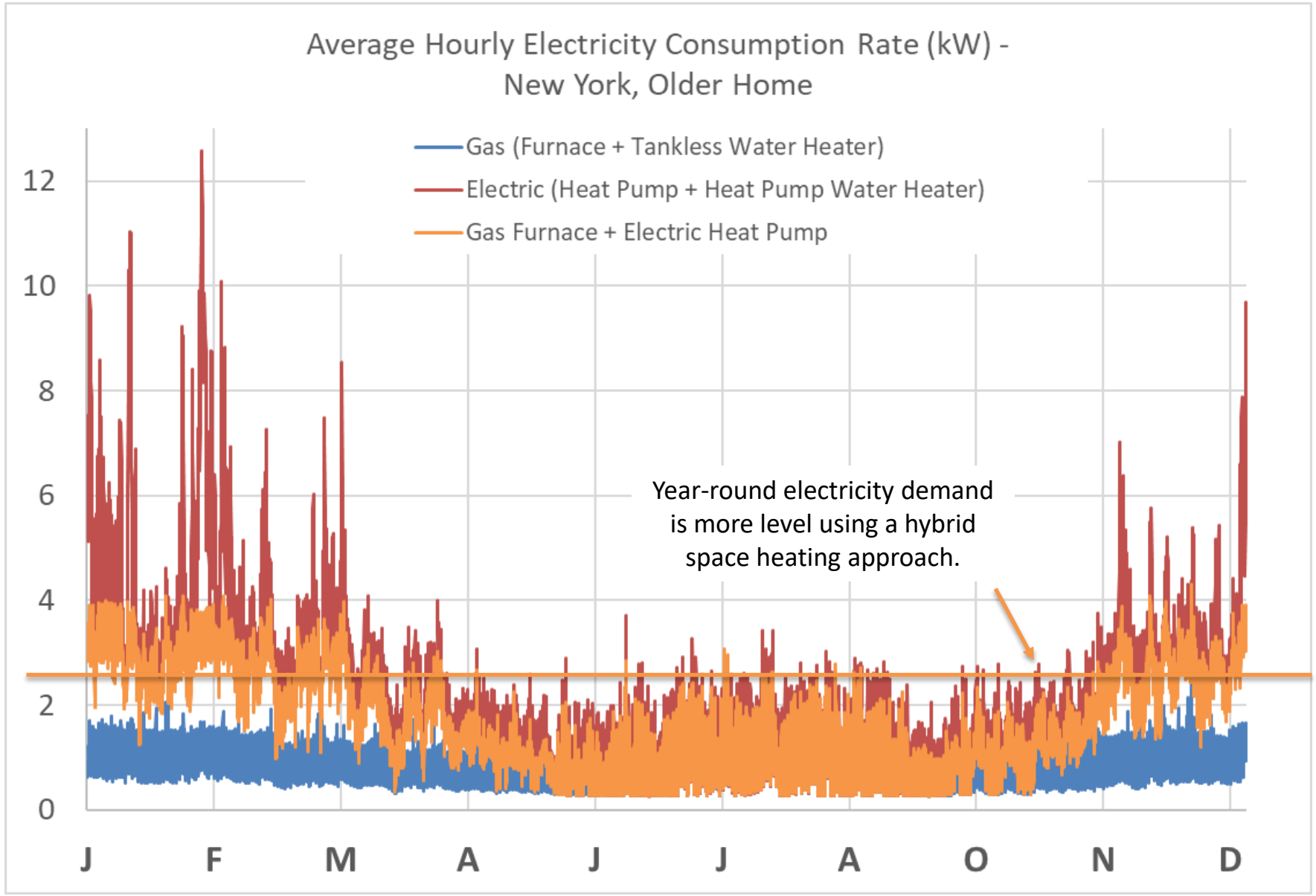
http://www.gastechnology.org/events/Documents/WGC2018-GTI-Presentations/Future-Residential-Natural-Gas-and-Electrification-in-Low-Carbon-Regions-Technical-Paper_Liss-Jun2018.pdf



Detailed yearly profile (8,760 hour) residential home electricity use model.

All-electric home experiences very high peak electric demand (with severe needle peaks) on cold days due to reduced electric heat pump efficiency and performance.

Expanding this to multiple homes would impose large burden on (dispatchable) electricity generation and electric transmission & distribution networks.



Compromise consideration:
Using an electric heat pump as a mild winter weather space heating complement to natural gas space heating is a reasonable option to consider (if cost-effective for consumers).

Modest cost: requires homeowners upgrade AC unit to electric heat pumps for new or replacement equipment.

Critical Infrastructure: Growing number of homes and businesses relying on natural gas pipeline network and onsite natural gas generators to ensure their power reliability

H-E-B to install natural gas 'microgrid' as backup generators at 45 stores in Houston

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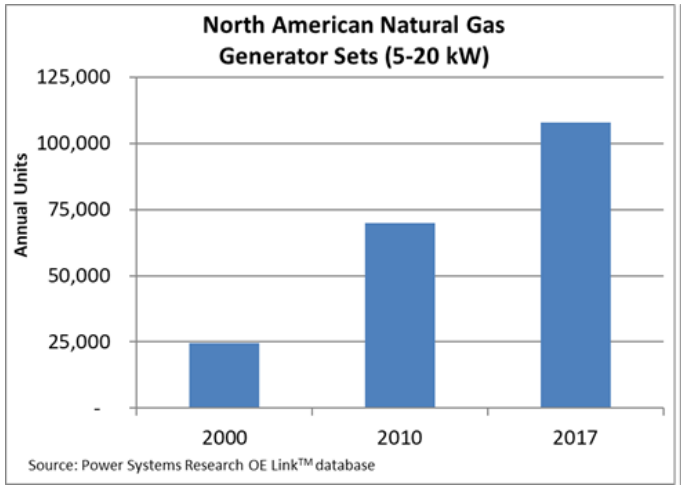
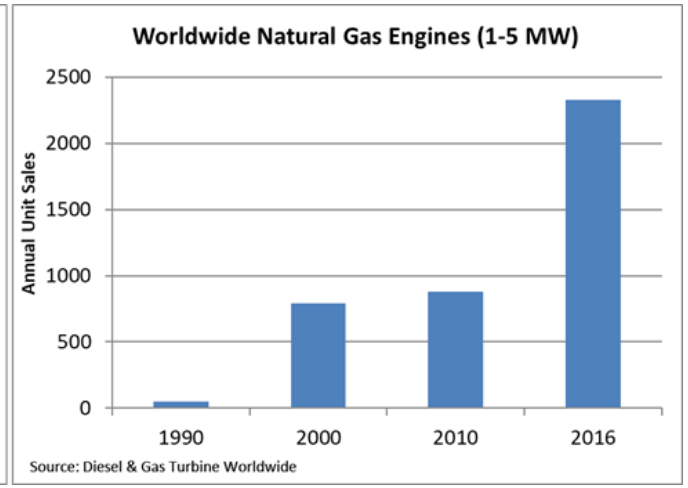
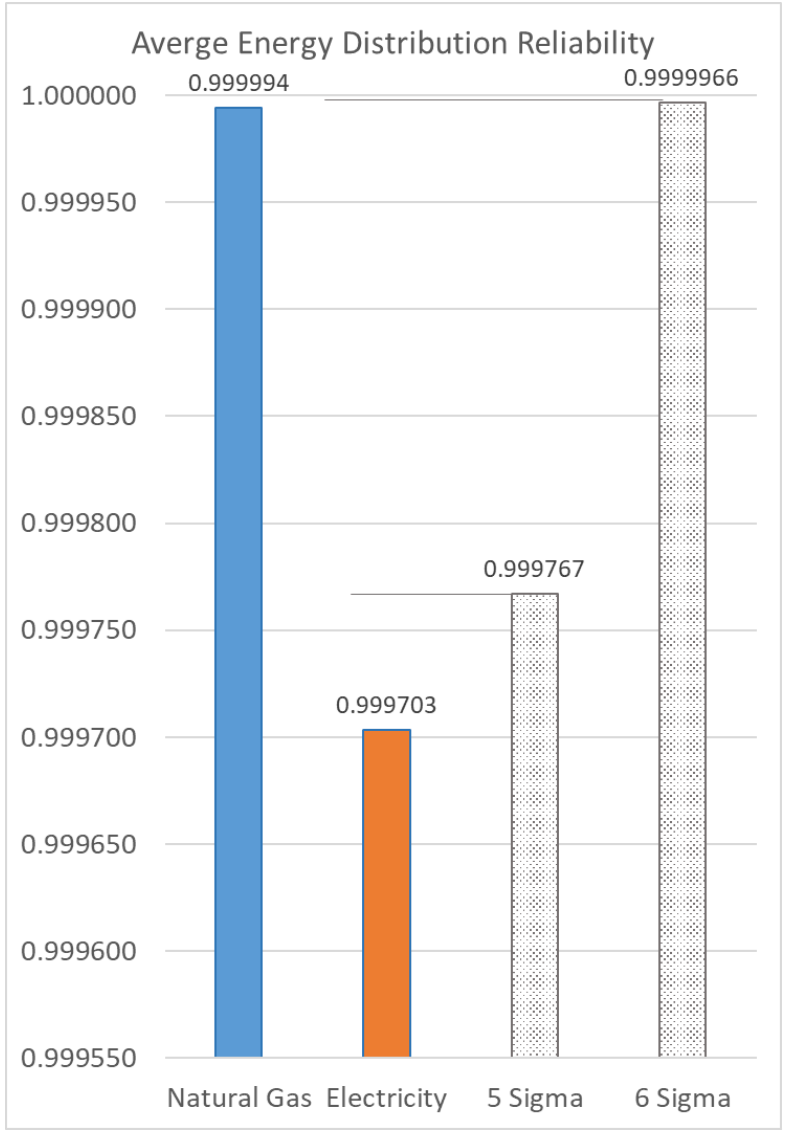


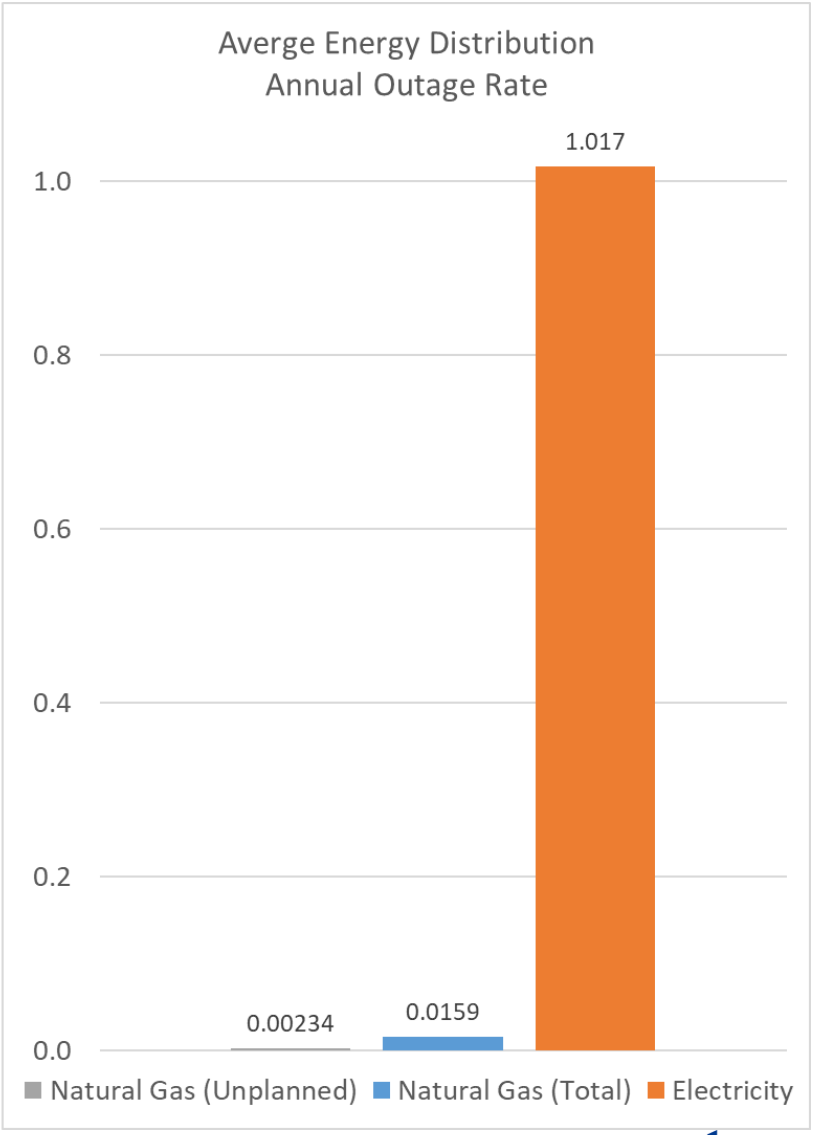


Energy Distribution Service Reliability

Summary of Survey Results

- Natural gas distribution achieves **"six sigma" reliability** levels and low outage rates
  - Mostly planned outages
- Electric distribution approaches "five sigma" reliability with higher annual outage rates
  - Mainly unplanned outages





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What Could End-use Energy Look Like in 2050 with Customer Choice?

Anda Ray
SVP, External Relations, Technical Resources and International Business

EPRI

NARUC Facilitator: Hon. Dianne Solomon, New Jersey

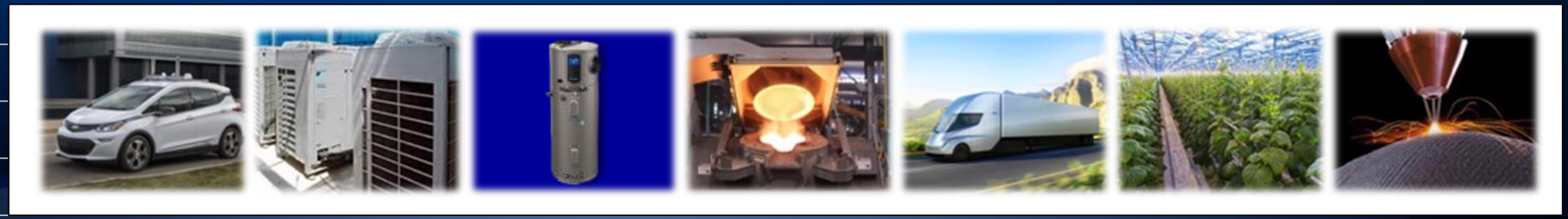
November 13, 2018

Integrated Energy Network…

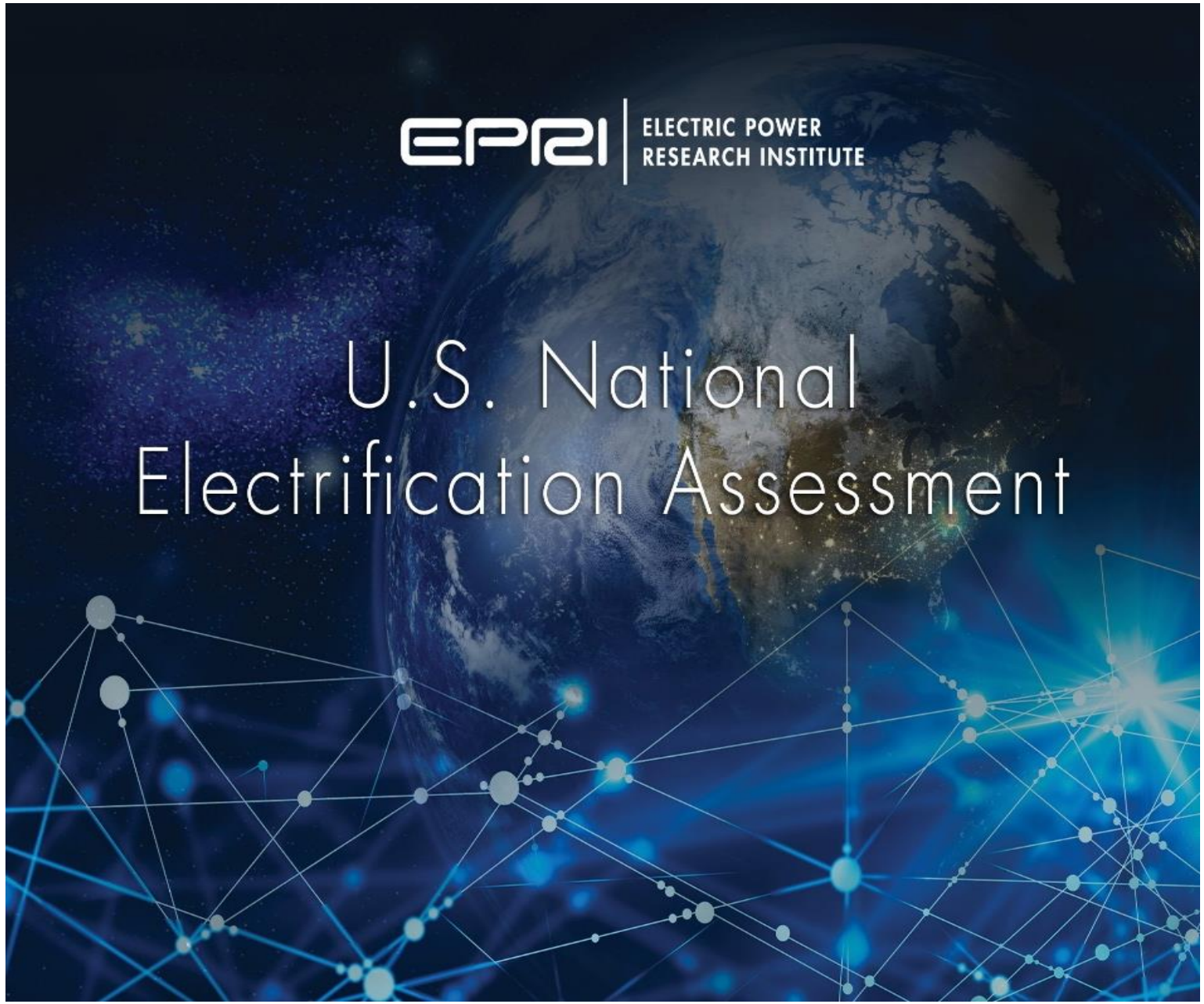
…Best Serves The Customer

Defines a pathway to the future which provides customers with the flexibility to use, produce, and manage energy the way they want – while ensuring universal access to reliable, safe, affordable, cleaner energy

End-use (Final) Energy By Sector



** Excludes upstream and midstream energy use, e.g., power generation, oil and gas extraction, refining, and pipelines*

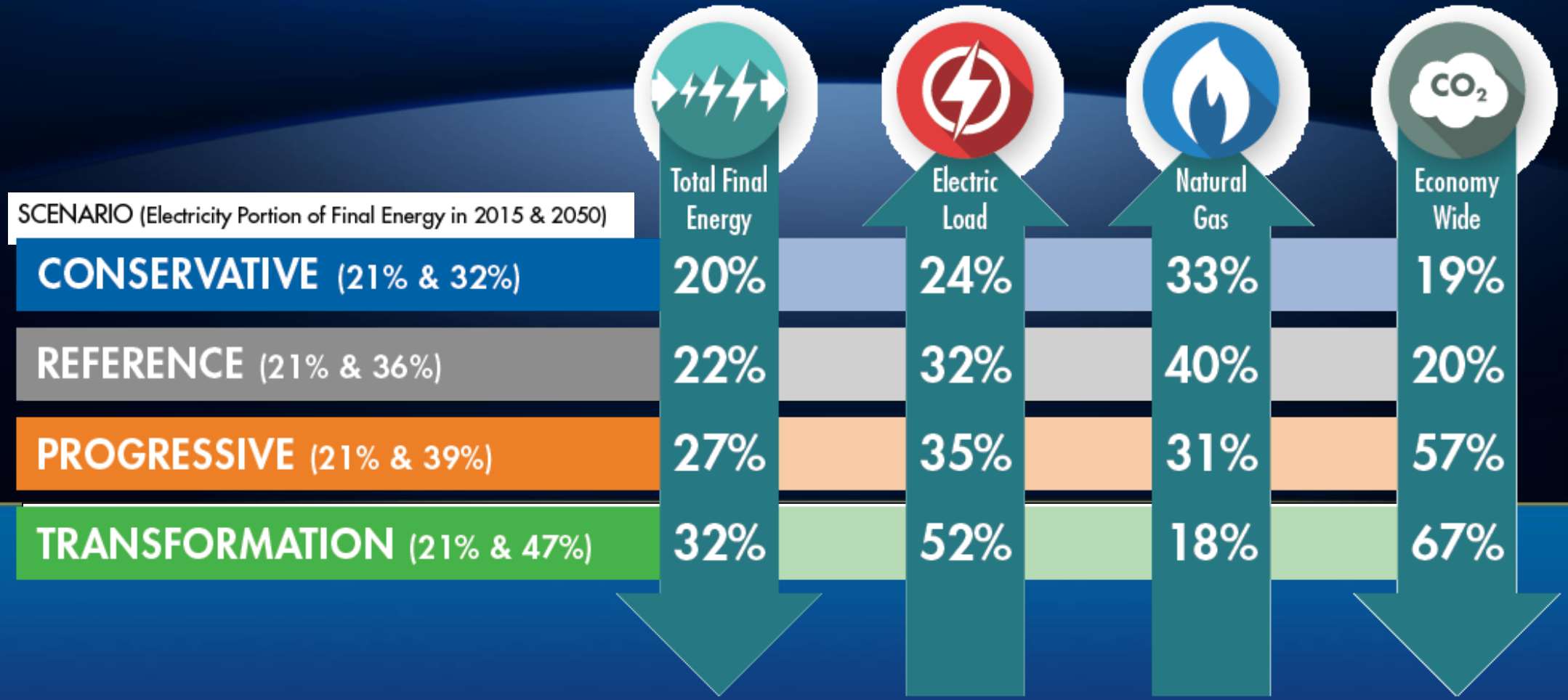


- **Customers have broad technology choices and control**
- **Economy-wide assessment**
- **Customer decisions integrated with detailed electricity supply model**

EPRI's U.S. National Electrification Assessment Scenarios

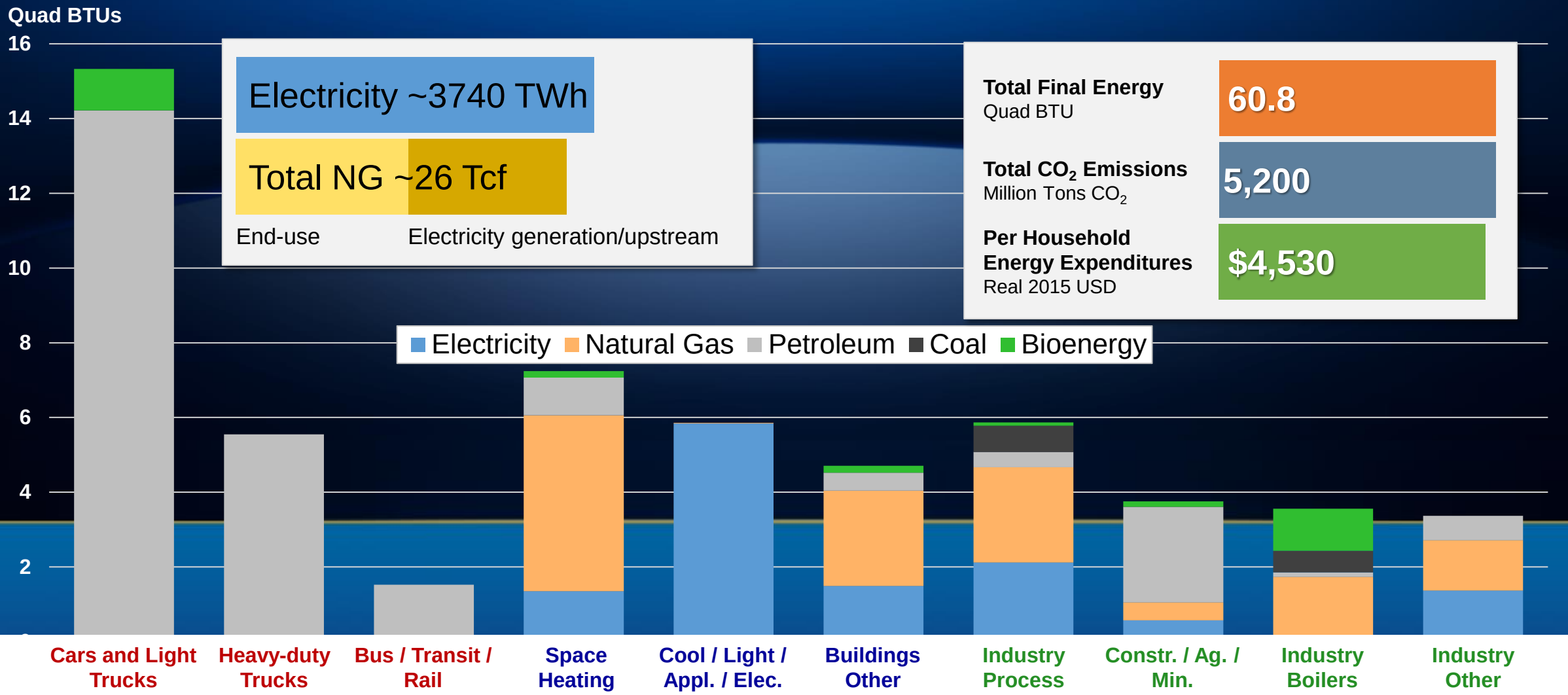
CONSERVATIVE	Slower Technology Change	• AEO 2017 growth path for GDP and service demands, and primary fuel prices • EPRI assumptions for cost and performance of technologies and energy efficiency over time • Existing, state-level policies and targets
REFERENCE	Reference Technology	
PROGRESSIVE	Reference Technology + Moderate Carbon Price	
TRANSFORMATION	Reference Technology + Stringent Carbon Price	

U.S. National Electrification Assessment (USNEA) – Results 2015-2050



EPRI ELECTRIC POWER RESEARCH INSTITUTE

Final Energy Use Today



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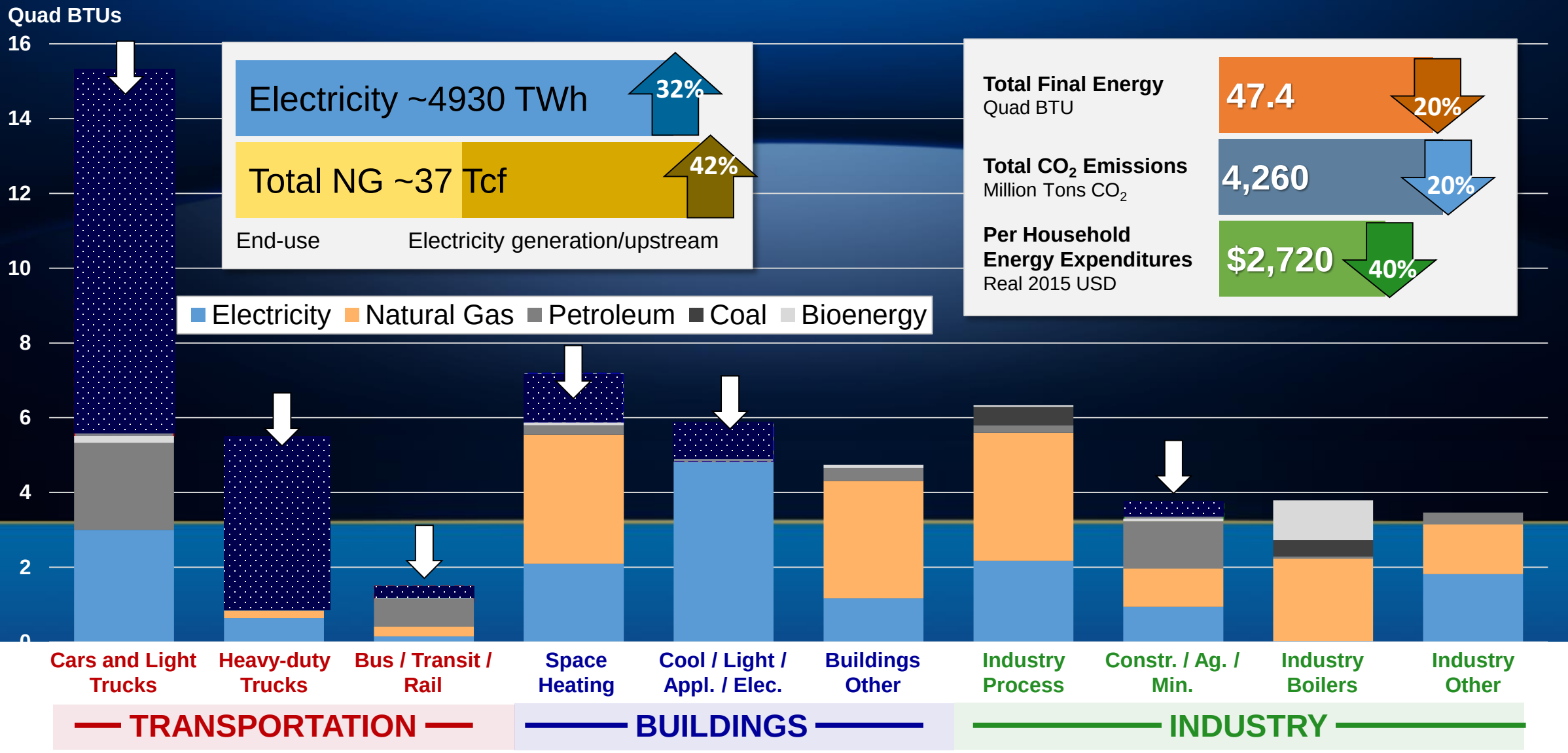
Final Energy Use in 2050

REFERENCE SCENARIO – No Federal Carbon Policy



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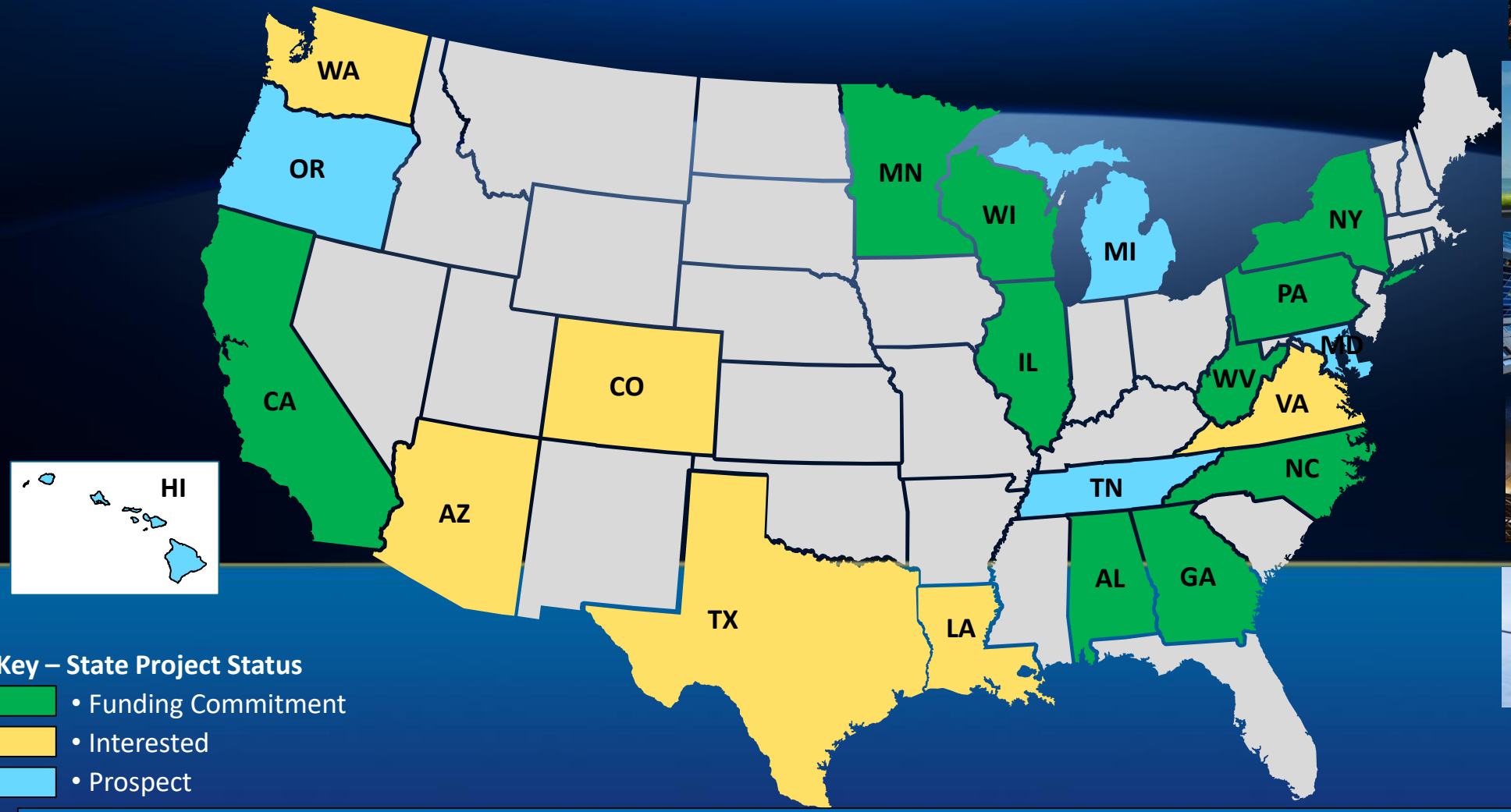
U.S. State & Utility Electrification Assessment Projects in Development



Key – State Project Status

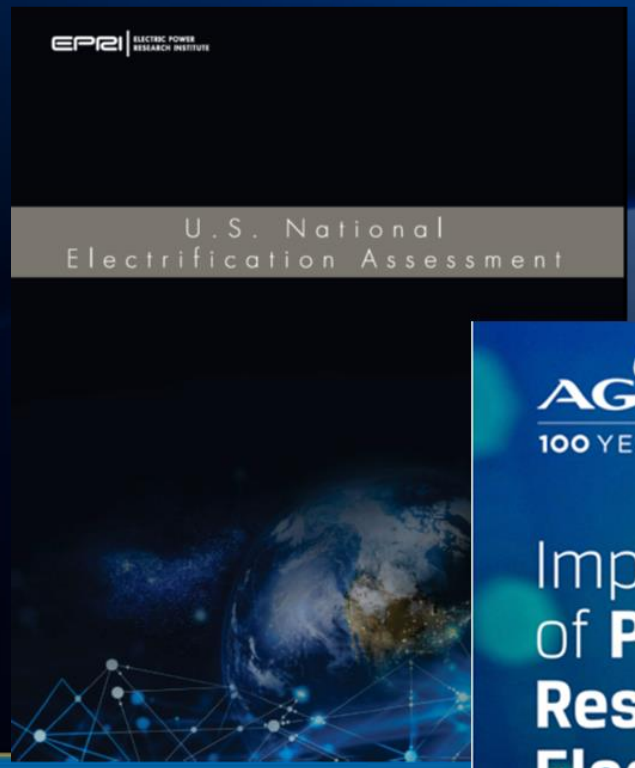
- Funding Commitment
- Interested
- Prospect

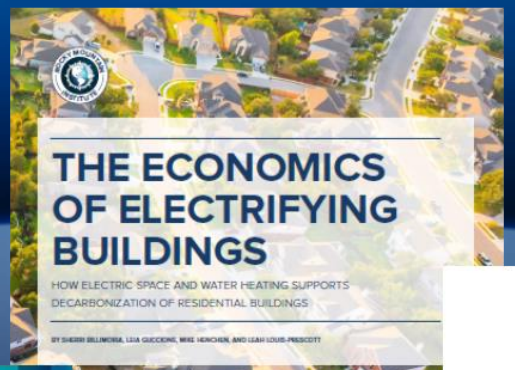
State Studies Address:

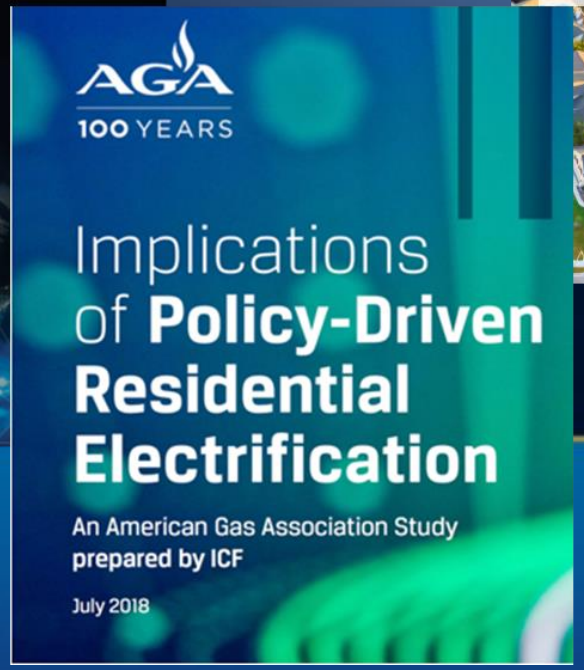
Current Participation: 10 States with 15 Members + Ontario

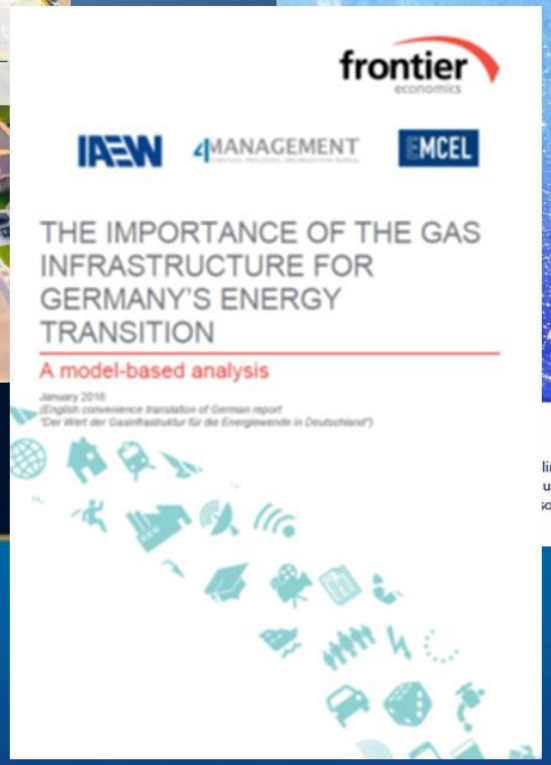
Update: October 16, 2018

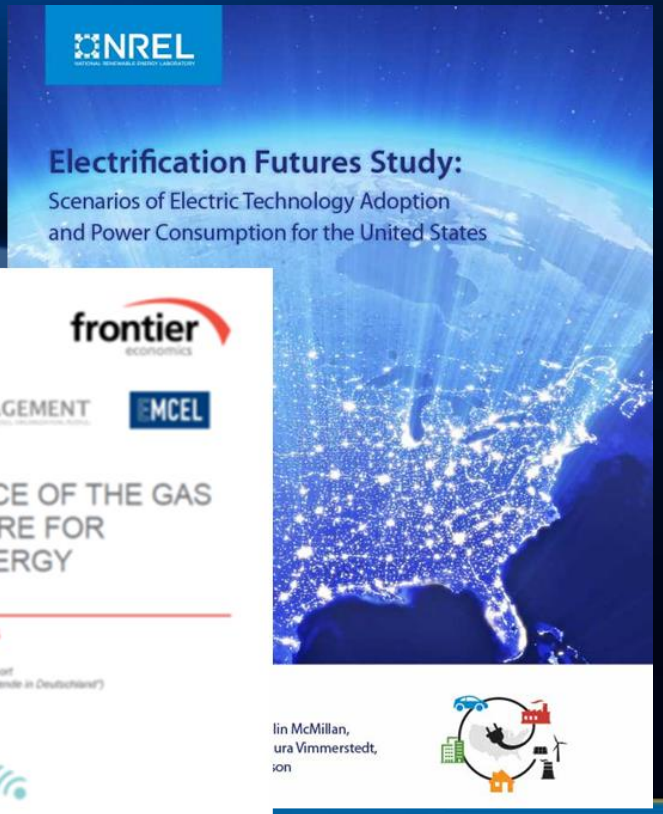
Electrification Studies: Separating the Insights From the Noise











Despite lots of modeling detail, different messages driven primarily by questions asked

Efficient Electrification – “Sustainable” Opportunities

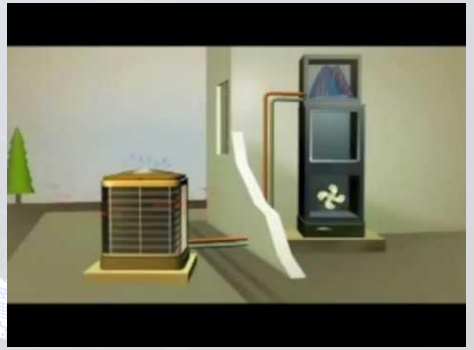
ELECTRIC VEHICLES

AIRPORT/PORT ELECTRIFICATION

SMART HOME DEVICES

ADVANCED MANUFACTURING

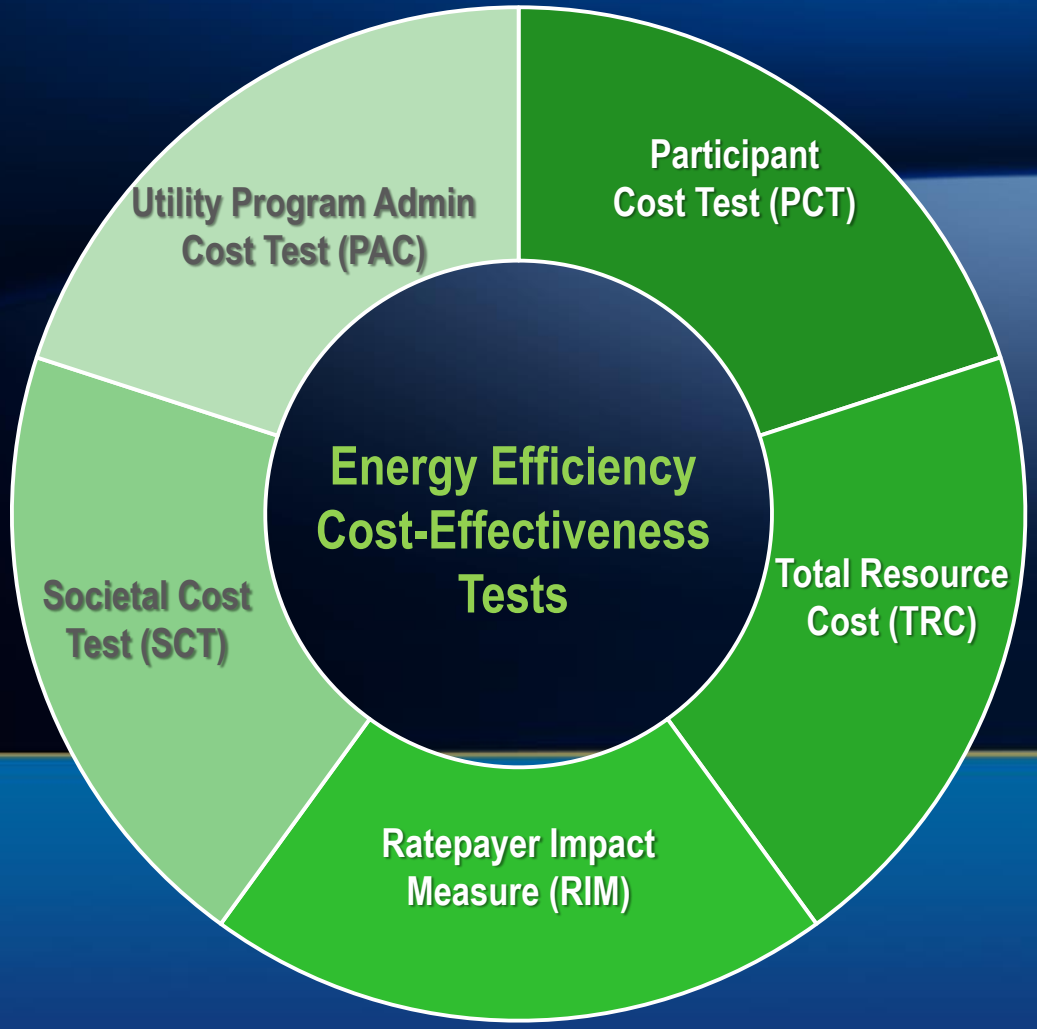
INDOOR AGRICULTURE



HYBRID RESIDENTIAL HEATING

Improve Productivity, Reduce Emissions, Reduce Cost, Deliver Other Non-Energy Benefits, and Make More Controllable

Efficient Electrification Benefits/Cost Framework… Leveraging Efficiency Cost-effectiveness Tests...



IS THE PARTICIPANT BETTER OFF? (PCT)

IS RESOURCE EFFICIENCY IMPROVED? (TRC)

ARE RATES LOWERED? (RIM)

ARE SOCIETAL COSTS LOWER? (SCT)

ARE REVENUE REQUIREMENTS LOWERED? (PAC)

KEY QUESTIONS

Together…Shaping the Future of Energy

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Session B2

Look under the "polls" button